

|  |                |                      |   |                            |  |   |                  |         |                         |                          |
|--|----------------|----------------------|---|----------------------------|--|---|------------------|---------|-------------------------|--------------------------|
| <b>EPA</b><br>United States Environmental Protection Agency<br>Washington, DC 20460<br><b>Work Assignment</b>  |                |                      |   |                            |  | Work Assignment Number<br>2-01  |                  |         |                         |                          |
|  |                |                      |   |                            |  | <input type="checkbox"/> Other <input type="checkbox"/> Amendment Number: |                  |         |                         |                          |
| Contract Number<br>EP-D-11-006   |                |                      | Contract Period   04/29/2011   To   03/28/2013<br>Base                      Option Period Number    1 |                            |  | Title of Work Assignment/SF Site Name<br>Cerium Ambient Sampling          |                  |         |                         |                          |
| Contractor<br>EASTERN RESEARCH GROUP, INC.   |                |                      |   |                            | Specify Section and paragraph of Contract SOW<br>G |   |                  |         |                         |                          |
| Purpose: <input checked="" type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out<br><input type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding<br><input type="checkbox"/> Work Plan Approval    |                |                      |   |                            |  | Period of Performance<br><br>From   04/01/2012   To   09/30/2012          |                  |         |                         |                          |
| Comments:<br>This work assignment includes 150 hours for preparation of the work plan and to begin work on the work assignment. To the best of my knowledge, this work does not duplicate any work previously performed or currently being performed by this office. |                |                      |   |                            |  |   |                  |         |                         |                          |
| <input type="checkbox"/> Superfund                      Accounting and Appropriations Data <input checked="" type="checkbox"/> Non-Superfund   |                |                      |   |                            |  |   |                  |         |                         |                          |
| Note: To report additional accounting and appropriations data use EPA Form 1900-69A.   |                |                      |   |                            |  |   |                  |         |                         |                          |
| SFO <input type="checkbox"/><br>(Max 2)  |                |                      |   |                            |  |   |                  |         |                         |                          |
| Line   | DCN<br>(Max 6) | Budget/FY<br>(Max 4) | Appropriation<br>Code (Max 6)   | Budget Org/Code<br>(Max 7) | Program Element<br>(Max 9)                         | Object Class<br>(Max 4)   | Amount (Dollars) | (Cents) | Site/Project<br>(Max 8) | Cost Org/Code<br>(Max 7) |
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| Authorized Work Assignment Ceiling   |                |                      |   |                            |  |   |                  |         |                         |                          |
| Contract Period:   |                | Cost/Fee:            |   |                            |  | LOE: 0  |                  |         |                         |                          |
| 04/29/2011 To 03/28/2013   |                |                      |   |                            |  |   |                  |         |                         |                          |
| This Action:   |                |                      |   |                            |  | 150   |                  |         |                         |                          |
|  |                |                      |   |                            |  |   |                  |         |                         |                          |
| Total:   |                |                      |   |                            |  | 150   |                  |         |                         |                          |
| Work Plan / Cost Estimate Approvals  |                |                      |   |                            |  |   |                  |         |                         |                          |
| Contractor WP Dated:   |                |                      |   | Cost/Fee:                  |  | LOE:  |                  |         |                         |                          |
|  |                |                      |   |                            |  |   |                  |         |                         |                          |
| Cumulative Approved:   |                |                      |   | Cost/Fee:                  |  | LOE:  |                  |         |                         |                          |
|  |                |                      |   |                            |  |   |                  |         |                         |                          |
| Work Assignment Manager Name   William Benjey  |                |                      |   |                            |  | Branch/Mail Code:   |                  |         |                         |                          |
| _____<br>(Signature)                      _____<br>(Date)  |                |                      |   |                            |  | Phone Number   919-541-0821   |                  |         |                         |                          |
|  |                |                      |   |                            |  | FAX Number:   |                  |         |                         |                          |
| Project Officer Name   Margaret Dougherty  |                |                      |   |                            |  | Branch/Mail Code:   |                  |         |                         |                          |
| _____<br>(Signature)                      _____<br>(Date)  |                |                      |   |                            |  | Phone Number: 919-541-2344  |                  |         |                         |                          |
|  |                |                      |   |                            |  | FAX Number:   |                  |         |                         |                          |
| Other Agency Official Name   |                |                      |   |                            |  | Branch/Mail Code:   |                  |         |                         |                          |
| _____<br>(Signature)                      _____<br>(Date)  |                |                      |   |                            |  | Phone Number:   |                  |         |                         |                          |
|  |                |                      |   |                            |  | FAX Number:   |                  |         |                         |                          |
| Contracting Official Name   Rodney-Daryl Jones   |                |                      |   |                            |  | Branch/Mail Code:   |                  |         |                         |                          |
| _____<br>(Signature)                      _____<br>(Date)  |                |                      |   |                            |  | Phone Number: 919-541-3112  |                  |         |                         |                          |
|  |                |                      |   |                            |  | FAX Number:   |                  |         |                         |                          |

## AMAD Newcastle, UK Ambient Sampling Work

- I. Title: Cerium Ambient Sampling  
 Contractor Name: ERG Inc.  
 Contract #: EP-D-11-006  
 WA #: 2-01
- II. Work Assignment Manager (WAM) and Alternate WAM:  
 WAM Name: William Benjey  
 U.S. Environmental Protection Agency  
 Program Office: ORD  
 Division/Lab: AMAD/NERL  
 Mail Code: E-243-01  
 City, State, Zip Code: Research Triangle Park, NC 27711  
 Phone w/area code: 919-541-0821
- Alt. WAM Name: Havala Pye  
 U.S. Environmental Protection Agency  
 Program Office: ORD  
 Division/Lab: AMAD/NERL  
 Mail Code: E243-03  
 City, State, Zip Code: Research Triangle Park, NC 27711  
 Phone w/area code: 919-541-3557

## III. Background:

Diesel vehicles are a major source of particulate matter. In an attempt to reduce PM<sub>2.5</sub> emissions and increase fuel efficiency, nanoparticle fuel additives have been developed, several of which are based on cerium oxide. For this work, size-segregated sampling of ambient PM will be conducted at the Newcastle Civic Center at Newcastle-upon-Tyne on St. Mary's Place in the United Kingdom. This scope of work addresses Phase II of the work assignment.

## IV. Description and Tasks:

The purpose of this work is to characterize near-road concentrations and deposition influenced by emissions from diesel vehicles using cerium oxide based fuel borne catalysts. This work assignment (Phase II) follows from information gained during Phase I of the field monitoring and the same site under WA1-06. Deliverables from the work include reports, plant samples, filter samples, and sample analysis. Phase II shall include collection of plant samples and attribution of the ambient cerium to diesel exhaust. Samples for bulk analysis (in-house EPA) will be collected along with several samples for Transmission Electron Microscopy (TEM) analysis (to be performed as part of this work assignment). The plant(s) identified in phase I will be collected and mailed to the EPA in Corvallis, Oregon for analysis. Two sets of PM<sub>10</sub> samples, at high and low traffic times respectively, shall also be collected to attribute ambient cerium levels to diesel exhaust. The contractor shall provide all necessary equipment and supplies except for filters for use in the MOUDI/nanoMOUDI and PM<sub>10</sub> instruments for bulk analysis.

The contractor shall perform the following tasks:

| Initial Deliverables  |                              |                                       |                     |   |  |
|---|------------------------------|---------------------------------------|---------------------|---|--|
| Task  | Deliverable                  | Expected Completion Date              | Suggested Equipment | Number of samples/ collection intervals | Additional Comments  |
| Develop a project work plan   | Report, Draft and Final      | 3 weeks after receipt of SOW from EPA | NA                  | NA                                      | Report shall be delivered as an electronic file in Word Document format for 8.5 by 11 inch paper.  |
| Prepare a revised Quality Assurance Project Plan (QAPP)   | Report, Draft and Final      | 3 weeks after receipt of SOW from EPA | NA                  | NA                                      | The QAPP shall be prepared in accordance with EPA guidance (EPA-QAR-5), and include a description of QA/QC steps to be followed for each task of this work assignment and persons responsible. The contractor shall revise the QAPP based on EPA comments and provide a final version. A summary QA report in electronic form shall be delivered, describing test results from each task of the work assignment. |
| Provide a Standard Operating Procedure (SOP) for transmission electron microscopy (TEM) or similar analysis | SOP/ Report, Draft and Final | 3 weeks after receipt of SOW from EPA | NA                  | NA                                      | The SOP shall be consistent with EPA QA/G-6-Guidance for Preparing Standard Operating Procedures. EPA will review and approve the SOP. SOP must be approved before samples are collected.  |

| Comprehensive Sampling Deliverables  |  |  |   |  |   |
|--|--|--|---|--|---|
| Task   | Deliverable  | Expected Completion Date   | Suggested Equipment                           | Number of samples/ collection intervals  | Additional Comments   |
| Obtain size-segregated samples of ambient particulate matter for bulk analysis | Exposed filters and blanks   | Due August 31, 2012; samples shall be mailed shortly after collection in batches | 12-stage MOUDI and nanoMOUDI cascade impactor | 6 total: 5 of which use a MOUDI while at least 1 uses a nanoMOUDI (this number may be revised higher or lower pending outcome of initial sampling)   | EPA will provide P5PJ047 zefluor filters (plus P5PJ037 zefluor for backup filter) for local pickup at EPA offices in RTP by ERG. Exposed filters and blanks shall be sent to the EPA in Research Triangle Park, NC, USA for ICP-MS analysis.  |
| TEM or similar analysis of size-segregated samples                             | Report including 4 images per stage analyzed, exposed filters with grids | Due August 31, 2012  | nanoMOUDI cascade impactor                    | 6 stages of 3 separate sampling episodes. The 6 smallest size stages should be analyzed and a minimum of 4 images per stage included in the report (6 x 3 x 4 = 72 images). nanoMOUDI stages: 8-13 (320 to 10 nm). The nanoMOUDI collection for TEM analysis shall be run in parallel as much as possible with the size-segregated MOUDI sampling for bulk analysis. | The contractor shall be responsible for providing TEM grids for sample collection. The existence of any of the following shall be noted and images included in draft and final reports, including:<br>Cerium oxide particles in primary form unattached to soot (approximately 5-10 nm in diameter or 13 to 26 nm in aerodynamic diameter).<br>Cerium oxide agglomerates, aggregates, or formations larger than primary size.<br>Cerium oxide attached to soot.<br>Cerium oxide inclusions in other materials.<br>Other cerium oxide or soot particles that are not mixed.<br>EPA also requires that the filters be shipped to them after analysis. |



|  |                            |                     |   |   |   |
|--|----------------------------|---------------------|---|---|---|
| Collect plant samples                                  | Vegetation samples         | Due August 31, 2012 | NA  | 1 collection                                | After the contractor notifies the EPA of which plants are available for sampling as part of Phase I deliverables, the EPA will decide which plants to sample. The contractor shall then sample the plants and return the samples to EPA in Corvallis, Oregon, USA. The shipment shall include pictures of the area where the plants were sampled and the plant from which the sample was taken. EPA will provide information on shipping and handling procedures based on the outcome of Phase I. The contractor shall be responsible for abiding by all rules and regulations in the UK and US regarding shipment of plants. |
| Collect PM10 samples during high and low-traffic times | Exposed filters and blanks | Due August 31, 2012 | 2 x Thermo Partisol 2025 based on phase I project plan  | Along with the size-segregated samples      | PM10 samples shall be collected at the same time as the size-segregated samples for bulk analysis with one set of the PM10 samples devoted to high bus-traffic times and the other set devoted to low bus traffic times. Filters shall be sent to the EPA for bulk analysis. EPA will provide teflon filters.   |
| Collect continuous meteorological data                 | Data                       | Due August 31, 2012 | 3-D sonic anemometer is desirable but 2-D will suffice. | Time resolution in data: 5 minutes or less. | Include: temperature, pressure, relative humidity, windspeed, wind direction, height of windspeed measurement, and mixing height/ atmospheric turbulence.   |
| High resolution video                                  | Video Clips/Data           | Due August 31, 2012 | NA  | Continuous during sampling                  | Continuously collect high resolution video during sample collection to capture the bus identification numbers and visible exhaust during sampling periods.  |

|   |  |   |   |   |  |
|---|--|---|---|---|--|
| Collect black carbon measurements                               | Data   | Due August 31, 2012   | microaethalometer (magee Scientific Model AE22 or microAeth Model AE51 based on phase I project plan) | Along with the size-segregated samples<br>Time resolution in data: 5 minutes or less. | Collect microaethalometer measurements of black carbon continuously during sampling periods.   |
| Provide documentation   | Log of sampling activities, Shipping manifests | Due September 30, 2012  | NA  | NA  | Field notes and shipping manifests shall be provided to EPA. The notes shall also include the exact location of where equipment was located during the sampling time periods as well as pictures of the site (at least once per month of sampling to capture changes in vegetation). |
| Obtain Automatic Urban and Rural Network (AURN) monitoring data | Data   | Due August 31, 2012   | AURN existing TEOM  | Time resolution in data: 5 minutes or less if available.                              | If available, provide sub-hourly PM10 and/or PM2.5 data from the AURN Newcastle Civic Center Monitoring site.  |
| <b>Final Report Deliverable</b>                                 |  |   |   |   |  |
| <b>Task</b>   | <b>Deliverable</b>                             | <b>Expected Completion Date</b>                                   | <b>Suggested Equipment</b>  | <b>Number of samples/ collection intervals</b>  | <b>Additional Comments</b>   |
| Provide a final report  | Report, Draft and Final                        | Draft due September 1, 2012 with final 2 weeks after EPA comments | NA  | NA  | Provide a draft final report in EPA report format, using Word. The report shall describe the sampling rationale, protocol, sampling completed, analysis performed by the contractor and a descriptive, graphical and statistical summary of monitoring results.                      |

|   |                |                      |   |                            |  |  |                  |         |                         |                          |
|---|----------------|----------------------|---|----------------------------|--|--|------------------|---------|-------------------------|--------------------------|
| <b>EPA</b><br>United States Environmental Protection Agency<br>Washington, DC 20460<br><b>Work Assignment</b>   |                |                      |   |                            |  | Work Assignment Number<br>2-01   |                  |         |                         |                          |
|   |                |                      |   |                            |  | <input type="checkbox"/> Other <input checked="" type="checkbox"/> Amendment Number:<br>000001 |                  |         |                         |                          |
| Contract Number<br>EP-D-11-006  |                |                      | Contract Period 04/29/2011 To 03/28/2013            |                            |  | Title of Work Assignment/SF Site Name  |                  |         |                         |                          |
|   |                |                      | Base                      Option Period Number    1 |                            |  | Cerium Ambient Sampling  |                  |         |                         |                          |
| Contractor<br>EASTERN RESEARCH GROUP, INC.  |                |                      |   |                            | Specify Section and paragraph of Contract SOW              |  |                  |         |                         |                          |
| Purpose: <input type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out<br><input checked="" type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding<br><input type="checkbox"/> Work Plan Approval   |                |                      |   |                            | Period of Performance<br><br>From 04/01/2012 To 09/30/2012 |  |                  |         |                         |                          |
| Comments:<br>The work plan dated 05/25/12 has been reviewed and we concur with the labor mix, technical hours (467.5), ODCs, total estimated cost \$139,046 and completion date 09/30/12. There are comments to the WP attached to this WC. The contractor shall submit a revised WP and cost estimate. This document is IAW the CMM 7.3.5.1(D) |                |                      |   |                            |  |  |                  |         |                         |                          |
| <input type="checkbox"/> Superfund                      Accounting and Appropriations Data <input checked="" type="checkbox"/> Non-Superfund  |                |                      |   |                            |  |  |                  |         |                         |                          |
| Note: To report additional accounting and appropriations date use EPA Form 1900-69A.  |                |                      |   |                            |  |  |                  |         |                         |                          |
| SFO <input type="checkbox"/> (Max 2)  |                |                      |   |                            |  |  |                  |         |                         |                          |
| Line  | DCN<br>(Max 6) | Budget/FY<br>(Max 4) | Appropriation<br>Code (Max 6)                       | Budget Org/Code<br>(Max 7) | Program Element<br>(Max 9)                                 | Object Class<br>(Max 4)  | Amount (Dollars) | (Cents) | Site/Project<br>(Max 8) | Cost Org/Code<br>(Max 7) |
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| Authorized Work Assignment Ceiling  |                |                      |   |                            |  |  |                  |         |                         |                          |
| Contract Period:  |                | Cost/Fee:            |   |                            |  | LOE: 150   |                  |         |                         |                          |
| 04/29/2011 To 03/28/2013  |                |                      |   |                            |  |  |                  |         |                         |                          |
| This Action:  |                |                      |   |                            |  | 318  |                  |         |                         |                          |
|   |                |                      |   |                            |  |  |                  |         |                         |                          |
| Total:  |                |                      |   |                            |  | 468  |                  |         |                         |                          |
| Work Plan / Cost Estimate Approvals   |                |                      |   |                            |  |  |                  |         |                         |                          |
| Contractor WP Dated:  |                |                      |   | Cost/Fee:                  |  | LOE:   |                  |         |                         |                          |
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| Cumulative Approved:  |                |                      |   | Cost/Fee:                  |  | LOE:   |                  |         |                         |                          |
|   |                |                      |   |                            |  |  |                  |         |                         |                          |
| Work Assignment Manager Name William Benjey   |                |                      |   |                            |  | Branch/Mail Code:  |                  |         |                         |                          |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  | Phone Number 919-541-0821  |                  |         |                         |                          |
|   |                |                      |   |                            |  | FAX Number:  |                  |         |                         |                          |
| Project Officer Name Margaret Dougherty   |                |                      |   |                            |  | Branch/Mail Code:  |                  |         |                         |                          |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  | Phone Number: 919-541-2344   |                  |         |                         |                          |
|   |                |                      |   |                            |  | FAX Number:  |                  |         |                         |                          |
| Other Agency Official Name  |                |                      |   |                            |  | Branch/Mail Code:  |                  |         |                         |                          |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  | Phone Number:  |                  |         |                         |                          |
|   |                |                      |   |                            |  | FAX Number:  |                  |         |                         |                          |
| Contracting Official Name Rodney-Daryl Jones  |                |                      |   |                            |  | Branch/Mail Code:  |                  |         |                         |                          |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  | Phone Number: 919-541-3112   |                  |         |                         |                          |
|   |                |                      |   |                            |  | FAX Number:  |                  |         |                         |                          |

**ATTACHMENT**

**Work Assignment Title:** Cerium Ambient Sampling  
**Contract #:** EP-D-11-006  
**Contractor:** ERG  
**WA#:** 2-01  
**WA Change #:** 1  
**WAM:** Bill Benjey

**Comments on Work Plan No. EP-D-11-006, WA 2-01**

Page 2-2: For additional clarity, the first paragraph after Task 2, From “For this subtask, EPA will provide...” through the end of that paragraph should be revised. A table is provided below (it can be added to the Work Plan for additional clarity if desired).

EPA will provide 47 mm zefluor filters (P5PJ047) for the upper stages of the MOUDI and 47mm MTL (PT47P) filters for the upper stages of the nanoMOUDI. EPA will provide 47 mm zefluor filters for the backup filter for the nanoMOUDI and 37mm zefluor filters (P5PJ037) for the backup filter in the MOUDI. Specifically, the EPA will provide the following filters:

|  | Number of collections | Filters per collection | Total Number of Filters | Part number  | Type of Filter |
|--|-----------------------|------------------------|-------------------------|--------------|----------------|
| MOUDI  | 5                     | 11                     | 55                      | P5PJ047      | 47 mm zefluor  |
| nanoMOUDI                                    | 1                     | 13                     | 13                      | PT47P/47M TL | 47 mm MTL      |
| MOUDI (backup)                               | 5                     | 1                      | 5                       | P5PJ037      | 37 mm zefluor  |
| nanoMOUDI (backup)                           | 1                     | 1                      | 1                       | P5PJ047      | 47 mm zefluor  |
| PM10 samples                                 | 6                     | 2                      | 12                      | PT47P/47M TL | 47 mm MTL      |
| nanoMOUDI for TEM (no grids provided)        | 3                     | 6                      | 18                      | PT47P/47M TL | 47 mm MTL      |
| nanoMOUDI for TEM (no grids provided) backup | 3                     | 1                      | 3                       | P5PJ047      | 47 mm zefluor  |
| blanks+spares                                | NA                    | NA                     | 11                      | P5PJ047      | 47 mm zefluor  |
| blanks+spares                                | NA                    | NA                     | 7                       | PT47P/47M TL | 47 mm MTL      |
| blanks+spares                                | NA                    | NA                     | 4                       | P5PJ037      | 37 mm zefluor  |
| Grand total                                  |                       |                        | 129                     |              |                |

Part P5PJ037: 2 um pore-size, 0.152 mm thickness,  
<http://www.pall.com/main/Laboratory/Product.page?id=20061>

Part P5PJ047: 2 um pore-size, 0.152 mm thickness,  
<http://www.pall.com/main/Laboratory/Product.page?id=20061>

Part PT47P: 0.2 um pore-size, 0.39 mm thickness, <http://www.mtlcorp.com/#/filters>

Page 2-3: At anytime when the filter ID number cannot be seen from the exterior of the package (for example, after the filters are wrapped in foil) the filter ID numbers contained in the batch should be indicated on the exterior of the package. When signing the chain of custody documents, the representative should indicate whether the package was opened to determine the individual numbers or obtained from the outside of the sealed package. Once exposed, the filters will ideally be unwrapped in a clean room for verification of numbers.

Page 5-1: There is a reference to “both options” (which should be removed).

Page 5-2: Can the name of the person providing the TEM analysis be mentioned?

General: Please add the table previously shown to us, with roles and responsibilities.

### **QAPP Comments:**

Page 6 of 17: Revise section on filters to be consistent with revisions to work plan.

Page 11 of 17: See comments about hidden filters numbers during shipment in work plan section. As an added check against misplaced filters, a picture of the exposed filters sitting in front of their stage should be taken when the MOUDI or nanoMOUDI is unloaded. Note the the Zefluor filters have a top and bottom and extra care should be taken not to flip them when transferring from petri dishes to the MOUDI stages.

|   |                |                      |   |                            |   |  |                  |         |                         |                          |
|---|----------------|----------------------|---|----------------------------|---|--|------------------|---------|-------------------------|--------------------------|
| <b>EPA</b><br>United States Environmental Protection Agency<br>Washington, DC 20460<br><b>Work Assignment</b>   |                |                      |   |                            |   | Work Assignment Number<br>2-01   |                  |         |                         |                          |
|   |                |                      |   |                            |   | <input type="checkbox"/> Other <input checked="" type="checkbox"/> Amendment Number:<br>000002 |                  |         |                         |                          |
| Contract Number<br>EP-D-11-006  |                |                      | Contract Period   04/29/2011   To   03/28/2013<br>Base                      Option Period Number      4 |                            |   | Title of Work Assignment/SF Site Name<br>Cerium Ambient Sampling                               |                  |         |                         |                          |
| Contractor<br>EASTERN RESEARCH GROUP, INC.  |                |                      |   |                            | Specify Section and paragraph of Contract SOW |  |                  |         |                         |                          |
| Purpose: <input type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out<br><input checked="" type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding<br><input type="checkbox"/> Work Plan Approval                                 |                |                      |   |                            |   | Period of Performance<br><br>From   04/01/2012   To   09/30/2012                               |                  |         |                         |                          |
| Comments:<br>The revised deliverable schedule dated 08/02/12 is approved with the following comment.   ERG shall submit rough draft report materials exclusive of the TEM analysis by 09/15/12.   A revised work plan and cost estimate is NOT required. This document is IAW the CMM 7.3.5.1(D). |                |                      |   |                            |   |  |                  |         |                         |                          |
| <input type="checkbox"/> Superfund                      Accounting and Appropriations Data <input checked="" type="checkbox"/> Non-Superfund  |                |                      |   |                            |   |  |                  |         |                         |                          |
| Note: To report additional accounting and appropriations date use EPA Form 1900-69A.  |                |                      |   |                            |   |  |                  |         |                         |                          |
| SFO <input type="checkbox"/><br>(Max 2)   |                |                      |   |                            |   |  |                  |         |                         |                          |
| Line  | DCN<br>(Max 6) | Budget/FY<br>(Max 4) | Appropriation<br>Code (Max 6)   | Budget Org/Code<br>(Max 7) | Program Element<br>(Max 9)                    | Object Class<br>(Max 4)  | Amount (Dollars) | (Cents) | Site/Project<br>(Max 8) | Cost Org/Code<br>(Max 7) |
| 1   |                |                      |   |                            |   |  |                  |         |                         |                          |
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| Authorized Work Assignment Ceiling  |                |                      |   |                            |   |  |                  |         |                         |                          |
| Contract Period:  |                | Cost/Fee:            |   |                            |   | LOE: 468   |                  |         |                         |                          |
| 04/29/2011   To   03/28/2013  |                |                      |   |                            |   |  |                  |         |                         |                          |
| This Action:  |                |                      |   |                            |   | 0  |                  |         |                         |                          |
|   |                |                      |   |                            |   |  |                  |         |                         |                          |
| Total:  |                |                      |   |                            |   | 468  |                  |         |                         |                          |
| Work Plan / Cost Estimate Approvals   |                |                      |   |                            |   |  |                  |         |                         |                          |
| Contractor WP Dated:  |                |                      |   | Cost/Fee:                  |   | LOE:   |                  |         |                         |                          |
| Cumulative Approved:  |                |                      |   | Cost/Fee:                  |   | LOE:   |                  |         |                         |                          |
| Work Assignment Manager Name   William Benjey<br><br><div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>                           |                |                      |   |                            |   | Branch/Mail Code:<br>Phone Number   919-541-0821<br>FAX Number:                                |                  |         |                         |                          |
| Project Officer Name   Margaret Dougherty<br><br><div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>                               |                |                      |   |                            |   | Branch/Mail Code:<br>Phone Number: 919-541-2344<br>FAX Number:                                 |                  |         |                         |                          |
| Other Agency Official Name<br><br><div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>  |                |                      |   |                            |   | Branch/Mail Code:<br>Phone Number:<br>FAX Number:  |                  |         |                         |                          |
| Contracting Official Name   Rodney-Daryl Jones<br><br><div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>                          |                |                      |   |                            |   | Branch/Mail Code:<br>Phone Number: 919-541-3112<br>FAX Number:                                 |                  |         |                         |                          |

|   |                |                      |   |                            |  |  |                            |         |                         |                          |
|---|----------------|----------------------|---|----------------------------|--|--|----------------------------|---------|-------------------------|--------------------------|
| <b>EPA</b><br>United States Environmental Protection Agency<br>Washington, DC 20460<br><b>Work Assignment</b>   |                |                      |   |                            |  | Work Assignment Number<br>2-01   |                            |         |                         |                          |
|   |                |                      |   |                            |  | <input type="checkbox"/> Other <input checked="" type="checkbox"/> Amendment Number:<br>000003 |                            |         |                         |                          |
| Contract Number<br>EP-D-11-006  |                |                      | Contract Period 04/29/2011 To 03/28/2013            |                            |  | Title of Work Assignment/SF Site Name  |                            |         |                         |                          |
|   |                |                      | Base                      Option Period Number    1 |                            |  | Cerium Ambient Sampling  |                            |         |                         |                          |
| Contractor<br>EASTERN RESEARCH GROUP, INC.  |                |                      |   |                            | Specify Section and paragraph of Contract SOW              |  |                            |         |                         |                          |
| Purpose: <input type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out<br><input checked="" type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding<br><input type="checkbox"/> Work Plan Approval |                |                      |   |                            | Period of Performance<br><br>From 04/01/2012 To 11/30/2012 |  |                            |         |                         |                          |
| Comments:<br>The purpose of this work change is to extend the WA period of performance through 11/30/2012. This document is IAW the CMM 7.3.5.1(D)  |                |                      |   |                            |  |  |                            |         |                         |                          |
| <input type="checkbox"/> Superfund                      Accounting and Appropriations Data <input checked="" type="checkbox"/> Non-Superfund  |                |                      |   |                            |  |  |                            |         |                         |                          |
| Note: To report additional accounting and appropriations data use EPA Form 1900-69A.  |                |                      |   |                            |  |  |                            |         |                         |                          |
| SFO (Max 2) <input type="checkbox"/>  |                |                      |   |                            |  |  |                            |         |                         |                          |
| Line  | DCN<br>(Max 6) | Budget/FY<br>(Max 4) | Appropriation<br>Code (Max 6)                       | Budget Org/Code<br>(Max 7) | Program Element<br>(Max 9)                                 | Object Class<br>(Max 4)  | Amount (Dollars)           | (Cents) | Site/Project<br>(Max 8) | Cost Org/Code<br>(Max 7) |
| 1   |                |                      |   |                            |  |  |                            |         |                         |                          |
| 2   |                |                      |   |                            |  |  |                            |         |                         |                          |
| 3   |                |                      |   |                            |  |  |                            |         |                         |                          |
| 4   |                |                      |   |                            |  |  |                            |         |                         |                          |
| 5   |                |                      |   |                            |  |  |                            |         |                         |                          |
| Authorized Work Assignment Ceiling  |                |                      |   |                            |  |  |                            |         |                         |                          |
| Contract Period:  |                | Cost/Fee:            |   |                            | LOE:   |  |                            |         |                         |                          |
| 04/29/2011 To 03/28/2013  |                |                      |   |                            |  |  |                            |         |                         |                          |
| This Action:  |                |                      |   |                            |  |  |                            |         |                         |                          |
| Total:  |                |                      |   |                            |  |  |                            |         |                         |                          |
| Work Plan / Cost Estimate Approvals   |                |                      |   |                            |  |  |                            |         |                         |                          |
| Contractor WP Dated:  |                |                      |   | Cost/Fee:                  |  |  | LOE:                       |         |                         |                          |
| Cumulative Approved:  |                |                      |   | Cost/Fee:                  |  |  | LOE:                       |         |                         |                          |
| Work Assignment Manager Name William Benjey   |                |                      |   |                            |  |  | Branch/Mail Code:          |         |                         |                          |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  |  | Phone Number 919-541-0821  |         |                         |                          |
|   |                |                      |   |                            |  |  | FAX Number:                |         |                         |                          |
| Project Officer Name Margaret Dougherty   |                |                      |   |                            |  |  | Branch/Mail Code:          |         |                         |                          |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  |  | Phone Number: 919-541-2344 |         |                         |                          |
|   |                |                      |   |                            |  |  | FAX Number:                |         |                         |                          |
| Other Agency Official Name  |                |                      |   |                            |  |  | Branch/Mail Code:          |         |                         |                          |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  |  | Phone Number:              |         |                         |                          |
|   |                |                      |   |                            |  |  | FAX Number:                |         |                         |                          |
| Contracting Official Name Rodney-Daryl Jones  |                |                      |   |                            |  |  | Branch/Mail Code:          |         |                         |                          |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  |  | Phone Number: 919-541-3112 |         |                         |                          |
|   |                |                      |   |                            |  |  | FAX Number:                |         |                         |                          |

|   |                |                      |   |                            |   |  |                  |         |                         |                          |
|---|----------------|----------------------|---|----------------------------|---|--|------------------|---------|-------------------------|--------------------------|
| <b>EPA</b><br>United States Environmental Protection Agency<br>Washington, DC 20460<br><b>Work Assignment</b>   |                |                      |   |                            |   | Work Assignment Number<br>2-01   |                  |         |                         |                          |
|   |                |                      |   |                            |   | <input type="checkbox"/> Other <input checked="" type="checkbox"/> Amendment Number:<br>000004 |                  |         |                         |                          |
| Contract Number<br>EP-D-11-006  |                |                      | Contract Period   04/29/2011   To   03/28/2013<br>Base                      Option Period Number    1 |                            |   | Title of Work Assignment/SF Site Name<br>Cerium Ambient Sampling                               |                  |         |                         |                          |
| Contractor<br>EASTERN RESEARCH GROUP, INC.  |                |                      |   |                            | Specify Section and paragraph of Contract SOW |  |                  |         |                         |                          |
| Purpose: <input type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out<br><input checked="" type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding<br><input type="checkbox"/> Work Plan Approval |                |                      |   |                            |   | Period of Performance<br><br>From   04/01/2012   To   11/30/2012                               |                  |         |                         |                          |
| Comments:<br>The purpose of this work change is to add 65 hours to the work assignment at no additional cost to the Government.<br>The contractor shall not submit a revised work plan or cost estimate. This document is IAW the CMM 7.3.5.1(D)                  |                |                      |   |                            |   |  |                  |         |                         |                          |
| <input type="checkbox"/> Superfund                      Accounting and Appropriations Data <input checked="" type="checkbox"/> Non-Superfund  |                |                      |   |                            |   |  |                  |         |                         |                          |
| Note: To report additional accounting and appropriations data use EPA Form 1900-69A.  |                |                      |   |                            |   |  |                  |         |                         |                          |
| SFO <input type="checkbox"/><br>(Max 2)   |                |                      |   |                            |   |  |                  |         |                         |                          |
| Line  | DCN<br>(Max 6) | Budget/FY<br>(Max 4) | Appropriation<br>Code (Max 6)   | Budget Org/Code<br>(Max 7) | Program Element<br>(Max 9)                    | Object Class<br>(Max 4)  | Amount (Dollars) | (Cents) | Site/Project<br>(Max 8) | Cost Org/Code<br>(Max 7) |
| 1   |                |                      |   |                            |   |  |                  |         |                         |                          |
| 2   |                |                      |   |                            |   |  |                  |         |                         |                          |
| 3   |                |                      |   |                            |   |  |                  |         |                         |                          |
| 4   |                |                      |   |                            |   |  |                  |         |                         |                          |
| 5   |                |                      |   |                            |   |  |                  |         |                         |                          |
| Authorized Work Assignment Ceiling  |                |                      |   |                            |   |  |                  |         |                         |                          |
| Contract Period:  |                | Cost/Fee:            |   |                            |   | LOE: 468   |                  |         |                         |                          |
| 04/29/2011 To 03/28/2013  |                |                      |   |                            |   |  |                  |         |                         |                          |
| This Action:  |                |                      |   |                            |   | 66   |                  |         |                         |                          |
|   |                |                      |   |                            |   |  |                  |         |                         |                          |
| Total:  |                |                      |   |                            |   | 533  |                  |         |                         |                          |
| Work Plan / Cost Estimate Approvals   |                |                      |   |                            |   |  |                  |         |                         |                          |
| Contractor WP Dated:  |                |                      |   | Cost/Fee:                  |   | LOE:   |                  |         |                         |                          |
| Cumulative Approved:  |                |                      |   | Cost/Fee:                  |   | LOE:   |                  |         |                         |                          |
| Work Assignment Manager Name   William Benjey<br><br><div style="display: flex; justify-content: space-between;"> <div>_____<br/>(Signature)</div> <div>_____<br/>(Date)</div> </div>   |                |                      |   |                            |   | Branch/Mail Code:<br>Phone Number   919-541-0821<br>FAX Number:                                |                  |         |                         |                          |
| Project Officer Name   Karen C. Watson<br><br><div style="display: flex; justify-content: space-between;"> <div>_____<br/>(Signature)</div> <div>_____<br/>(Date)</div> </div>  |                |                      |   |                            |   | Branch/Mail Code:<br>Phone Number: 919-541-3114<br>FAX Number:                                 |                  |         |                         |                          |
| Other Agency Official Name<br><br><div style="display: flex; justify-content: space-between;"> <div>_____<br/>(Signature)</div> <div>_____<br/>(Date)</div> </div>  |                |                      |   |                            |   | Branch/Mail Code:<br>Phone Number:<br>FAX Number:  |                  |         |                         |                          |
| Contracting Official Name   Rodney-Daryl Jones<br><br><div style="display: flex; justify-content: space-between;"> <div>_____<br/>(Signature)</div> <div>_____<br/>(Date)</div> </div>  |                |                      |   |                            |   | Branch/Mail Code:<br>Phone Number: 919-541-3112<br>FAX Number:                                 |                  |         |                         |                          |



|   |                |                      |   |                            |  |  |                             |         |                         |   |
|---|----------------|----------------------|---|----------------------------|--|--|-----------------------------|---------|-------------------------|---|
| <b>EPA</b><br>United States Environmental Protection Agency<br>Washington, DC 20460<br><b>Work Assignment</b>   |                |                      |   |                            |  | Work Assignment Number<br>2-01   |                             |         |                         |   |
|   |                |                      |   |                            |  | <input type="checkbox"/> Other <input checked="" type="checkbox"/> Amendment Number:<br>000005 |                             |         |                         |   |
| Contract Number<br>EP-D-11-006  |                |                      | Contract Period   04/29/2011   To   03/28/2013        |                            |  | Title of Work Assignment/SF Site Name  |                             |         |                         |   |
|   |                |                      | Base                      Option Period Number      1 |                            |  | Cerium Ambient Sampling  |                             |         |                         |   |
| Contractor<br>EASTERN RESEARCH GROUP, INC.  |                |                      |   |                            | Specify Section and paragraph of Contract SOW                    |  |                             |         |                         |   |
| Purpose: <input type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out<br><input checked="" type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding<br><input type="checkbox"/> Work Plan Approval |                |                      |   |                            | Period of Performance<br><br>From   04/01/2012   To   02/15/2013 |  |                             |         |                         |   |
| Comments:<br>The purpose of this work change is to extend the period of performance at no-cost from ending dates of 11/30/2012 to 02/15/2013. The resulting revised List of Deliverables is attached.<br><br>This document is in accordance with CMM 7.3.5.1(D).  |                |                      |   |                            |  |  |                             |         |                         |   |
| <input type="checkbox"/> Superfund  |                |                      |   |                            | Accounting and Appropriations Data                               |  |                             |         |                         | <input checked="" type="checkbox"/> Non-Superfund |
| Note: To report additional accounting and appropriations data use EPA Form 1900-69A.  |                |                      |   |                            |  |  |                             |         |                         |   |
| SFO <input type="checkbox"/><br>(Max 2)   |                |                      |   |                            |  |  |                             |         |                         |   |
| Line  | DCN<br>(Max 6) | Budget/FY<br>(Max 4) | Appropriation<br>Code (Max 6)                         | Budget Org/Code<br>(Max 7) | Program Element<br>(Max 9)                                       | Object Class<br>(Max 4)  | Amount (Dollars)            | (Cents) | Site/Project<br>(Max 8) | Cost Org/Code<br>(Max 7)                          |
| 1   |                |                      |   |                            |  |  |                             |         |                         |   |
| 2   |                |                      |   |                            |  |  |                             |         |                         |   |
| 3   |                |                      |   |                            |  |  |                             |         |                         |   |
| 4   |                |                      |   |                            |  |  |                             |         |                         |   |
| 5   |                |                      |   |                            |  |  |                             |         |                         |   |
| Authorized Work Assignment Ceiling  |                |                      |   |                            |  |  |                             |         |                         |   |
| Contract Period:  |                | Cost/Fee:            |   |                            | LOE:   |  |                             |         |                         |   |
| 04/29/2011   To   03/28/2013  |                |                      |   |                            |  |  |                             |         |                         |   |
| This Action:  |                |                      |   |                            |  |  |                             |         |                         |   |
| Total:  |                |                      |   |                            |  |  |                             |         |                         |   |
| Work Plan / Cost Estimate Approvals   |                |                      |   |                            |  |  |                             |         |                         |   |
| Contractor WP Dated:  |                |                      |   | Cost/Fee:                  |  |  | LOE:                        |         |                         |   |
| Cumulative Approved:  |                |                      |   | Cost/Fee:                  |  |  | LOE:                        |         |                         |   |
| Work Assignment Manager Name   William Benjey   |                |                      |   |                            |  |  | Branch/Mail Code:           |         |                         |   |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  |  | Phone Number   919-541-0821 |         |                         |   |
|   |                |                      |   |                            |  |  | FAX Number:                 |         |                         |   |
| Project Officer Name   Karen C. Watson  |                |                      |   |                            |  |  | Branch/Mail Code:           |         |                         |   |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  |  | Phone Number: 919-541-3114  |         |                         |   |
|   |                |                      |   |                            |  |  | FAX Number:                 |         |                         |   |
| Other Agency Official Name  |                |                      |   |                            |  |  | Branch/Mail Code:           |         |                         |   |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  |  | Phone Number:               |         |                         |   |
|   |                |                      |   |                            |  |  | FAX Number:                 |         |                         |   |
| Contracting Official Name   Rodney-Daryl Jones  |                |                      |   |                            |  |  | Branch/Mail Code:           |         |                         |   |
| _____<br>(Signature)                      (Date)  |                |                      |   |                            |  |  | Phone Number: 919-541-3112  |         |                         |   |
|   |                |                      |   |                            |  |  | FAX Number:                 |         |                         |   |

| <b>Deliverable</b>  | <b>Date to EPA</b>   |
|---|--|
| <b>Task 1 Deliverable</b>   |  |
| Work Plan   | Draft - May 25, 2012   |
|   | Final – one week after receiving comments on the draft work plan   |
| SOP for TEM analysis  | Draft – June 26, 2012  |
|   | Final – one week after receiving comments on the draft SOP   |
| QAPP  | Draft – May 25, 2012   |
|   | Final – one week after receiving comments on the draft AQPP  |
| Monthly Progress reports  | Monthly commencing on May 15, 2012   |
| <b>Task 2 Comprehensive Sampling</b>                              |  |
| Implement passive exhaust sampling                                | Send samples in batches as soon as sampling episode is completed – final batch no later than August 31, 2012 |
| Implement size segregated, PM <sub>10</sub> , and TEM sampling    |  |
| Implement vegetative sampling                                     |  |
| Collect microaethalometer data for black carbon                   |  |
| Compile meteorological and AURN data                              |  |
| Compile video data for bus identification                         |  |
| Analysis of TEM samples   | January 18, 2013   |
| Compile documentation, field notes, photos and shipping manifests | February 1, 2013   |
| <b>Task 3 Final Report</b>  |  |
| Draft report  | February 1, 2013   |
| Final report  | One week after receiving EPA comments on Draft Phase II Report   |

|   |                |                      |   |                            |  |  |                             |         |                         |   |
|---|----------------|----------------------|---|----------------------------|--|--|-----------------------------|---------|-------------------------|---|
| <b>EPA</b><br>United States Environmental Protection Agency<br>Washington, DC 20460<br><b>Work Assignment</b>   |                |                      |   |                            |  | Work Assignment Number<br>2-01   |                             |         |                         |   |
|   |                |                      |   |                            |  | <input type="checkbox"/> Other <input checked="" type="checkbox"/> Amendment Number:<br>000006 |                             |         |                         |   |
| Contract Number<br>EP-D-11-006  |                |                      | Contract Period   04/29/2011   To   03/31/2013        |                            |  | Title of Work Assignment/SF Site Name  |                             |         |                         |   |
|   |                |                      | Base                      Option Period Number      1 |                            |  | Cerium Ambient Sampling  |                             |         |                         |   |
| Contractor<br>EASTERN RESEARCH GROUP, INC.  |                |                      |   |                            | Specify Section and paragraph of Contract SOW                    |  |                             |         |                         |   |
| Purpose: <input type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out<br><input checked="" type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding<br><input type="checkbox"/> Work Plan Approval                       |                |                      |   |                            | Period of Performance<br><br>From   04/12/2012   To   03/28/2013 |  |                             |         |                         |   |
| Comments:<br>This amendment (1) revises the Statement of Work (as attached) and (2) extends the period of performance until 3/31/13. The contractor is requested to provide a cost estimate only for the additional effort.<br><br>This amendment is in accordance with CMM 7.3.5.1(D). |                |                      |   |                            |  |  |                             |         |                         |   |
| <input type="checkbox"/> Superfund  |                |                      |   |                            | Accounting and Appropriations Data                               |  |                             |         |                         | <input checked="" type="checkbox"/> Non-Superfund |
| Note: To report additional accounting and appropriations date use EPA Form 1900-69A.  |                |                      |   |                            |  |  |                             |         |                         |   |
| SFO <input type="checkbox"/><br>(Max 2)   |                |                      |   |                            |  |  |                             |         |                         |   |
| Line  | DCN<br>(Max 6) | Budget/FY<br>(Max 4) | Appropriation<br>Code (Max 6)                         | Budget Org/Code<br>(Max 7) | Program Element<br>(Max 9)                                       | Object Class<br>(Max 4)  | Amount (Dollars)            | (Cents) | Site/Project<br>(Max 8) | Cost Org/Code<br>(Max 7)                          |
| 1   |                |                      |   |                            |  |  |                             |         |                         |   |
| 2   |                |                      |   |                            |  |  |                             |         |                         |   |
| 3   |                |                      |   |                            |  |  |                             |         |                         |   |
| 4   |                |                      |   |                            |  |  |                             |         |                         |   |
| 5   |                |                      |   |                            |  |  |                             |         |                         |   |
| Authorized Work Assignment Ceiling  |                |                      |   |                            |  |  |                             |         |                         |   |
| Contract Period:  |                | Cost/Fee:            |   |                            | LOE:   |  |                             |         |                         |   |
| 04/29/2011   To   03/31/2013  |                |                      |   |                            |  |  |                             |         |                         |   |
| This Action:  |                |                      |   |                            |  |  |                             |         |                         |   |
| Total:  |                |                      |   |                            |  |  |                             |         |                         |   |
| Work Plan / Cost Estimate Approvals   |                |                      |   |                            |  |  |                             |         |                         |   |
| Contractor WP Dated:  |                |                      | Cost/Fee:   |                            |  | LOE:   |                             |         |                         |   |
| Cumulative Approved:  |                |                      | Cost/Fee:   |                            |  | LOE:   |                             |         |                         |   |
| Work Assignment Manager Name   William Benjey   |                |                      |   |                            |  |  | Branch/Mail Code:           |         |                         |   |
| _____<br>(Signature)    (Date)  |                |                      |   |                            |  |  | Phone Number   919-541-0821 |         |                         |   |
|   |                |                      |   |                            |  |  | FAX Number:                 |         |                         |   |
| Project Officer Name   Karen C. Watson  |                |                      |   |                            |  |  | Branch/Mail Code:           |         |                         |   |
| _____<br>(Signature)    (Date)  |                |                      |   |                            |  |  | Phone Number: 919-541-3114  |         |                         |   |
|   |                |                      |   |                            |  |  | FAX Number:                 |         |                         |   |
| Other Agency Official Name  |                |                      |   |                            |  |  | Branch/Mail Code:           |         |                         |   |
| _____<br>(Signature)    (Date)  |                |                      |   |                            |  |  | Phone Number:               |         |                         |   |
|   |                |                      |   |                            |  |  | FAX Number:                 |         |                         |   |
| Contracting Official Name   Rodney-Daryl Jones  |                |                      |   |                            |  |  | Branch/Mail Code:           |         |                         |   |
| _____<br>(Signature)    (Date)  |                |                      |   |                            |  |  | Phone Number: 919-541-3112  |         |                         |   |
|   |                |                      |   |                            |  |  | FAX Number:                 |         |                         |   |

## AMAD Newcastle, UK Ambient Sampling Work

- I. Title: Cerium Ambient Sampling  
 Contractor Name: ERG Inc.  
 Contract #: EP-D-11-006  
 WA #: 2-01, Rev. 1
- II. Work Assignment Manager (WAM) and Alternate WAM:  
 WAM Name: William Benjey  
 U.S. Environmental Protection Agency  
 Program Office: ORD  
 Division/Lab: AMAD/NERL  
 Mail Code: E-243-02  
 City, State, Zip Code: Research Triangle Park, NC 27711  
 Phone w/area code: 919-541-0821  
 Alt. WAM Name: Havala Pye  
 U.S. Environmental Protection Agency  
 Program Office: ORD  
 Division/Lab: AMAD/NERL  
 Mail Code: E243-03  
 City, State, Zip Code: Research Triangle Park, NC 27711  
 Phone w/area code: 919-541-3557  
 Level of Effort  
 Labor Hours: 500  
 Duration: ~~Six months~~ 12 months  
 Completion Date: ~~9/30/2012~~ 3/31/13

## III. Background:

Diesel vehicles are a major source of particulate matter. In an attempt to reduce PM<sub>2.5</sub> emissions and increase fuel efficiency, nanoparticle fuel additives have been developed, several of which are based on cerium oxide. For this work, size-segregated sampling of ambient PM will be conducted at the Newcastle Civic Center at Newcastle-upon-Tyne on St. Mary's Place in the United Kingdom. This scope of work addresses Phase II of the work assignment.

## IV. Description and Tasks:

The purpose of this work is to characterize near-road concentrations and deposition influenced by emissions from diesel vehicles using cerium oxide based fuel borne catalysts. This work assignment (Phase II) follows from information gained during Phase I of the field monitoring and the same site under WA1-06. Deliverables from the work include reports, plant samples, filter samples, and sample analysis. Phase II shall include collection of plant samples and attribution of the ambient cerium to diesel exhaust. Samples for bulk analysis (in-house EPA) will be collected along with several samples for Transmission Electron Microscopy (TEM) analysis (to be performed as part of this work assignment). The plant(s) identified in phase I will be collected and mailed to the EPA in Corvallis, Oregon for analysis. Two sets of PM<sub>10</sub> samples, at high and low traffic times respectively, shall also be collected to attribute ambient cerium levels to diesel exhaust. The contractor shall provide all necessary equipment and supplies except for filters for use in the MOUDI/nanoMOUDI and PM<sub>10</sub> instruments for bulk analysis.

As a part of Revision 1 to this work assignment the contractor shall collect dust and soil samples at the monitoring site using EPA-provided sampling kits. Specifically:

1. 3 surface pavement dust samples (~250 ml each) from the Stagecoach Bus Depot (3 representative sites).
2. 3 street dust samples (~ 250 ml each) from the roadway (St. Mary's Place) in front of the monitoring site (3 representative sites)
3. 3 samples of soil (~250 ml) each from the field adjacent to the monitoring site (3 sites)

Additional sampling supplies will be provided which shall be used to collect samples at other sites that the Contractor deems potentially relevant to the Newcastle monitoring study. The Contractor shall ship the samples to the Project Officer for subsequent preparation and analysis.

#### *Soil Sample Collection Methods*

EPA will provide sampling kits containing a detailed sample collection SOP with field sampling log sheet, powder-free gloves, acid-cleaned disposable polypropylene scoops, polypropylene bottles (500 ml), silicone brushes for each sample collected, and sample custody tape. Three grab samples at different sites for each type of dust or soil collected will be considered adequate provide a representative sample collection.

Loose surface street dusts and pavement dusts shall be swept into the polypropylene scoops and dumped into the polypropylene bottles.

Soil samples shall be collected at a depth of 0 to 1/2 inches by scooping the soil into the polypropylene bottles using a clean scoop. Clean powder-free gloves will be used at each sampling location to minimize the chance of cross contamination. The Contractor shall collect approximately 250 ml of dust or soil (half a bottle) for each sample. If the area adjacent to the monitoring site is grass covered, three (3) small areas of grass will be removed and the first 0-1/2 inches of soil below the grass cover will be collected from the area. The grass will be removed with a small disposable trowel provided in the sampling kit. Care will be taken to replace the grass and clean soil potting will be added below the grass to restore the sample area.

The Contractor shall document the sampling site for each sample with photographs and written notes on the field log sheets.

The contractor shall perform the following tasks:

| Initial Deliverables  |                              |                                       |                     |   |  |
|---|------------------------------|---------------------------------------|---------------------|---|--|
| Task  | Deliverable                  | Expected Completion Date              | Suggested Equipment | Number of samples/ collection intervals | Additional Comments  |
| Develop a project work plan   | Report, Draft and Final      | 3 weeks after receipt of SOW from EPA | NA                  | NA                                      | Report shall be delivered as an electronic file in Word Document format for 8.5 by 11 inch paper.  |
| Prepare a revised Quality Assurance Project Plan (QAPP)   | Report, Draft and Final      | 3 weeks after receipt of SOW from EPA | NA                  | NA                                      | The QAPP shall be prepared in accordance with EPA guidance (EPA-QAR-5), and include a description of QA/QC steps to be followed for each task of this work assignment and persons responsible. The contractor shall revise the QAPP based on EPA comments and provide a final version. A summary QA report in electronic form shall be delivered, describing test results from each task of the work assignment. |
| Provide a Standard Operating Procedure (SOP) for transmission electron microscopy (TEM) or similar analysis | SOP/ Report, Draft and Final | 3 weeks after receipt of SOW from EPA | NA                  | NA                                      | The SOP shall be consistent with EPA QA/G-6-Guidance for Preparing Standard Operating Procedures. EPA will review and approve the SOP. SOP must be approved before samples are collected.  |

| Comprehensive Sampling Deliverables  |  |  |   |  |  |
|--|--|--|---|--|--|
| Task   | Deliverable  | Expected Completion Date   | Suggested Equipment                           | Number of samples/ collection intervals  | Additional Comments  |
| Obtain size-segregated samples of ambient particulate matter for bulk analysis | Exposed filters and blanks   | Due August 31, 2012; samples shall be mailed shortly after collection in batches | 12-stage MOUDI and nanoMOUDI cascade impactor | 6 total: 5 of which use a MOUDI while at least 1 uses a nanoMOUDI (this number may be revised higher or lower pending outcome of initial sampling)   | EPA will provide P5PJ047 zefluor filters (plus P5PJ037 zefluor for backup filter) for local pickup at EPA offices in RTP by ERG. Exposed filters and blanks shall be sent to the EPA in Research Triangle Park, NC, USA for ICP-MS analysis.   |
| TEM or similar analysis of size-segregated samples                             | Report including 4 images per stage analyzed, exposed filters with grids | Due August 31, 2012  | nanoMOUDI cascade impactor                    | 6 stages of 3 separate sampling episodes. The 6 smallest size stages should be analyzed and a minimum of 4 images per stage included in the report (6 x 3 x 4 = 72 images).<br>nanoMOUDI stages: 8-13 (320 to 10 nm).<br>The nanoMOUDI collection for TEM analysis shall be run in parallel as much as possible with the size-segregated MOUDI sampling for bulk analysis. | The contractor shall be responsible for providing TEM grids for sample collection.<br>The existence of any of the following shall be noted and images included in draft and final reports, including:<br>Cerium oxide particles in primary form unattached to soot (approximately 5-10 nm in diameter or 13 to 26 nm in aerodynamic diameter).<br>Cerium oxide agglomerates, aggregates, or formations larger than primary size.<br>Cerium oxide attached to soot.<br>Cerium oxide inclusions in other materials.<br>Other cerium oxide or soot particles that are not mixed.<br>EPA also requires that the filters be shipped to them after analysis. |

|  |                            |                     |   |   |   |
|--|----------------------------|---------------------|---|---|---|
| Collect plant samples                                  | Vegetation samples         | Due August 31, 2012 | NA  | 1 collection                                | After the contractor notifies the EPA of which plants are available for sampling as part of Phase I deliverables, the EPA will decide which plants to sample. The contractor shall then sample the plants and return the samples to EPA in Corvallis, Oregon, USA. The shipment shall include pictures of the area where the plants were sampled and the plant from which the sample was taken. EPA will provide information on shipping and handling procedures based on the outcome of Phase I. The contractor shall be responsible for abiding by all rules and regulations in the UK and US regarding shipment of plants. |
| Collect PM10 samples during high and low-traffic times | Exposed filters and blanks | Due August 31, 2012 | 2 x Thermo Partisol 2025 based on phase I project plan  | Along with the size-segregated samples      | PM10 samples shall be collected at the same time as the size-segregated samples for bulk analysis with one set of the PM10 samples devoted to high bus-traffic times and the other set devoted to low bus traffic times. Filters shall be sent to the EPA for bulk analysis. EPA will provide teflon filters.   |
| Collect continuous meteorological data                 | Data                       | Due August 31, 2012 | 3-D sonic anemometer is desirable but 2-D will suffice. | Time resolution in data: 5 minutes or less. | Include: temperature, pressure, relative humidity, windspeed, wind direction, height of windspeed measurement, and mixing height/ atmospheric turbulence.   |
| High resolution video                                  | Video Clips/Data           | Due August 31, 2012 | NA  | Continuous during sampling                  | Continuously collect high resolution video during sample collection to capture the bus identification numbers and visible exhaust during sampling periods.  |



| Collect black carbon measurements                               | Data   | Due August 31, 2012                                      | microaethalometer (magee Scientific Model AE22 or microAeth Model AE51 based on phase I project plan) | Along with the size-segregated samples<br>Time resolution in data: 5 minutes or less. | Collect microaethalometer measurements of black carbon continuously during sampling periods.   |
|---|--|--|---|---|--|
| Provide documentation   | Log of sampling activities, Shipping manifests | Due September 30, 2012                                   | NA  | NA  | Field notes and shipping manifests shall be provided to EPA. The notes shall also include the exact location of where equipment was located during the sampling time periods as well as pictures of the site (at least once per month of sampling to capture changes in vegetation). |
| Obtain Automatic Urban and Rural Network (AURN) monitoring data | Data   | Due August 31, 2012                                      | AURN existing TEOM  | Time resolution in data: 5 minutes or less if available.                              | If available, provide sub-hourly PM10 and/or PM2.5 data from the AURN Newcastle Civic Center Monitoring site.  |
| Obtain Surface pavement dust, street dust, and soil samples     | Samples prepared and shipped to the EPA PO     | March 8, 2013  | EPA-provided sampling kits  | 3 samples of each type, collected in accordance to the above described procedures.    | Sampling shall be documented with photographs and notes written on field log sheets.   |
| Final Report Deliverable  |  |  |   |   |  |
| Task  | Deliverable                                    | Expected Completion Date                                 | Suggested Equipment   | Number of samples/ collection intervals   | Additional Comments  |
| Provide a final report  | Report, Draft and Final                        | Draft due March 10, 2013<br><del>September 1, 2012</del> | NA  | NA  | Provide a draft final report in EPA report format, using Word. The report shall describe the sampling rationale, protocol, sampling completed, analysis performed by   |

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|  |  |                                       |  |  |  |
|--|--|---------------------------------------|--|--|--|
|  |  | with final 2 weeks after EPA comments |  |  | the contractor and a descriptive, graphical and statistical summary of monitoring results. |
|--|--|---------------------------------------|--|--|--|

|  |                |                      |   |                            |   |  |   |         |                         |                          |
|--|----------------|----------------------|---|----------------------------|---|--|---|---------|-------------------------|--------------------------|
| <b>EPA</b><br>United States Environmental Protection Agency<br>Washington, DC 20460<br><b>Work Assignment</b>  |                |                      |   |                            |   | Work Assignment Number<br>2-01   |   |         |                         |                          |
|  |                |                      |   |                            |   | <input type="checkbox"/> Other <input checked="" type="checkbox"/> Amendment Number:<br>000007 |   |         |                         |                          |
| Contract Number<br>EP-D-11-006   |                |                      | Contract Period   04/29/2011   To   03/31/2014<br>Base <input checked="" type="checkbox"/> Option Period Number |                            |   | Title of Work Assignment/SF Site Name  |   |         |                         |                          |
| Contractor<br>EASTERN RESEARCH GROUP, INC.   |                |                      |   |                            | Specify Section and paragraph of Contract SOW |  |   |         |                         |                          |
| Purpose: <input type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out<br><input checked="" type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding<br><input type="checkbox"/> Work Plan Approval        |                |                      |   |                            |   | Period of Performance<br><br>From   04/12/2012   To   03/31/2013                               |   |         |                         |                          |
| Comments:<br>This Work Assignment Change extends the Period of Performance to read:03/31/2013 in accordance with the Period of Performance end date of Option Period I.<br><br>This amendment is in accordance with CMM 7.3.5.1 (D)                                      |                |                      |   |                            |   |  |   |         |                         |                          |
| <input type="checkbox"/> Superfund                      Accounting and Appropriations Data <input checked="" type="checkbox"/> Non-Superfund   |                |                      |   |                            |   |  |   |         |                         |                          |
| Note: To report additional accounting and appropriations date use EPA Form 1900-69A.   |                |                      |   |                            |   |  |   |         |                         |                          |
| SFO <input type="checkbox"/><br>(Max 2)  |                |                      |   |                            |   |  |   |         |                         |                          |
| Line   | DCN<br>(Max 6) | Budget/FY<br>(Max 4) | Appropriation<br>Code (Max 6)   | Budget Org/Code<br>(Max 7) | Program Element<br>(Max 9)                    | Object Class<br>(Max 4)  | Amount (Dollars)  | (Cents) | Site/Project<br>(Max 8) | Cost Org/Code<br>(Max 7) |
| 1  |                |                      |   |                            |   |  |   |         |                         |                          |
| 2  |                |                      |   |                            |   |  |   |         |                         |                          |
| 3  |                |                      |   |                            |   |  |   |         |                         |                          |
| 4  |                |                      |   |                            |   |  |   |         |                         |                          |
| 5  |                |                      |   |                            |   |  |   |         |                         |                          |
| Authorized Work Assignment Ceiling   |                |                      |   |                            |   |  |   |         |                         |                          |
| Contract Period:                      Cost/Fee:                      LOE:<br>04/29/2011   To   03/31/2014  |                |                      |   |                            |   |  |   |         |                         |                          |
| This Action:   |                |                      |   |                            |   |  |   |         |                         |                          |
| Total:   |                |                      |   |                            |   |  |   |         |                         |                          |
| Work Plan / Cost Estimate Approvals  |                |                      |   |                            |   |  |   |         |                         |                          |
| Contractor WP Dated:                      Cost/Fee:                      LOE:  |                |                      |   |                            |   |  |   |         |                         |                          |
| Cumulative Approved:                      Cost/Fee:                      LOE:  |                |                      |   |                            |   |  |   |         |                         |                          |
| Work Assignment Manager Name   William Benjey<br><br><div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>  |                |                      |   |                            |   |  | Branch/Mail Code:<br>Phone Number   919-541-0821<br>FAX Number: |         |                         |                          |
| Project Officer Name   Karen C. Watson<br><br><div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>         |                |                      |   |                            |   |  | Branch/Mail Code:<br>Phone Number: 919-541-3114<br>FAX Number:  |         |                         |                          |
| Other Agency Official Name<br><br><div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>                     |                |                      |   |                            |   |  | Branch/Mail Code:<br>Phone Number:<br>FAX Number:               |         |                         |                          |
| Contracting Official Name   Rodney-Daryl Jones<br><br><div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div> |                |                      |   |                            |   |  | Branch/Mail Code:<br>Phone Number: 919-541-3112<br>FAX Number:  |         |                         |                          |